

# UNIT 1

## IOWA'S FORESTRY RESOURCE BASE

### Geological Record

Iowa's unique soil, topography, and human interactions determine the type of plants that grow in the state. The Iowa landscape has gone through some drastic changes in its geologic past. This lengthy history is recorded in the layers of rock that make up the land that is Iowa.

Iowa had mountain ranges 4½ billion to 570 million years ago. Pressure at the bases of the mountains formed metamorphic and igneous rocks (e.g., quartzite, granite).

From 570 to 230 million years ago, Iowa was in a tropical latitude (about where Central America is today) covered with a shallow sea. Thousands of feet of sedimentary rock (limestone, shale, dolomite, and coal) were laid during this time. Fossils of sharks' teeth, coral, and many other marine creatures are found in these rocks.

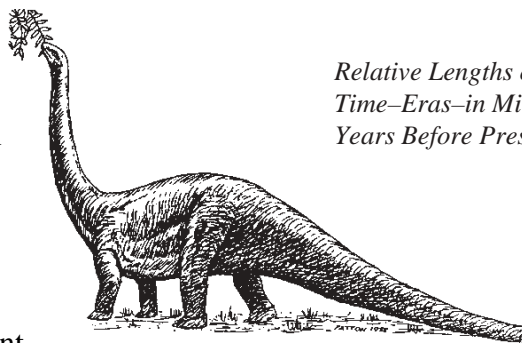
Dinosaurs lived in the state 230 to 65 million years ago. The landscape was subtropical with coastal swamps, great rivers, and giant flood plains. Bird and mammal groups first appeared also.

The continents began drifting into their current positions 65 million years ago. As temperatures cooled, massive glaciers periodically covered Iowa.

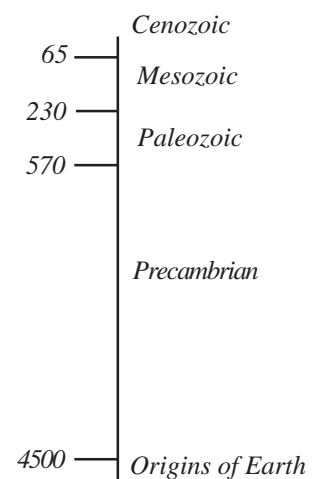
### The Ice Age

The effects of the Ice Age (2.5 million to 10,000 years ago) are most visible to us today. Global temperatures dropped, precipitation in the polar-regions increased, and mounds of glacial ice formed. It began to move under the stress of its own weight. Iowa was covered by the advancing ice. Temperatures rose periodically and moisture from the oceans no longer made it to the polar-regions, so the glaciers began to melt. The huge river valleys of the Missouri and Mississippi were scoured out by the enormous amounts of glacial melt water. Each glacier changed the landscape by adding ice and wind deposited sediments, burying the old rugged landscape to make it flat.

Iowa's climate during the time between glaciations was much like Canada's is today. Researchers can tell from examination of fossil bark, leaves, twigs, fruits, and pollen that evergreen forests of pine and spruce covered Iowa during interglacial periods. Mammoths, mastodons, stag-moose, musk ox, giant beaver, and ground sloths roamed Iowa between glaciations.



*Relative Lengths of Geologic Time—Eras—in Millions of Years Before Present*



The entire state was not covered with ice each time a glacier arrived. Northeast Iowa is the oldest area left unglaciated. Streams and rivers have had time to erode the landscape to the bedrock. The terrain is very steep and large outcroppings of bedrock cliffs can be seen along the waterways.



*Pikes Peak State Park, Paleozoic Plateau*

*Geological Survey Bureau, IDNR*

Southern and west central Iowa have gently rolling hills created by 1/2 million years of erosion.



*Southern Iowa Drift Plain*

*Geological Survey Bureau, IDNR*

Northwest and central Iowa were glaciated most recently. This part of the state is flat and features many shallow depressions dug out by the glaciers. These depressions formed numerous marshes and the Iowa Great Lakes.



*Des Moines Lobe*

*Geological Survey Bureau, IDNR*

The glaciers retreated for the last time about 11,500 years ago. The climate warmed. Iowa was covered by a deciduous forest of oak, elm, maple, and basswood. The climate grew warmer and drier. Forests gave way to prairie.

### **Soil Formation**

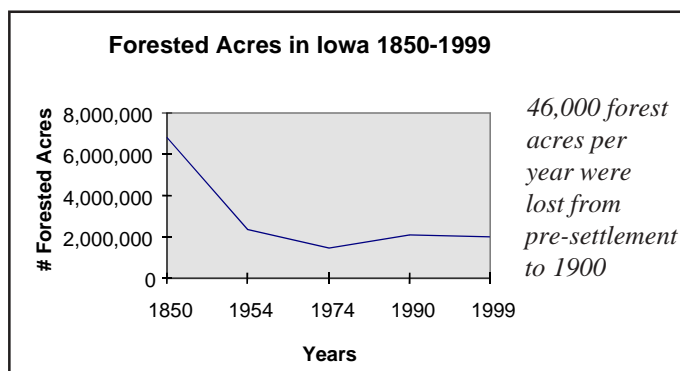
All these geologic and climatic changes have provided the bedrock and parent materials for Iowa's current soils. Freezing, thawing, wind, rain, sun, and organisms have changed these parent materials into 450 different soil types.

A soil type holds clues about the kind of plants that formed it and what kind of plants will grow well in it. For example, the amount of organic matter in prairie soils differs from that in forest soils. Prairie grasses and **forbes** (flowers) die back each winter and grow a new root system every three to four years. Decomposition in the sun and wind is relatively quick. Trees drop their leaves each fall, but do not grow entirely new root systems. The ground in the forest is protected from wind and sun, so decomposition is slower. Forest soils generally are thinner and lighter in color than the fertile black soils of the prairie.

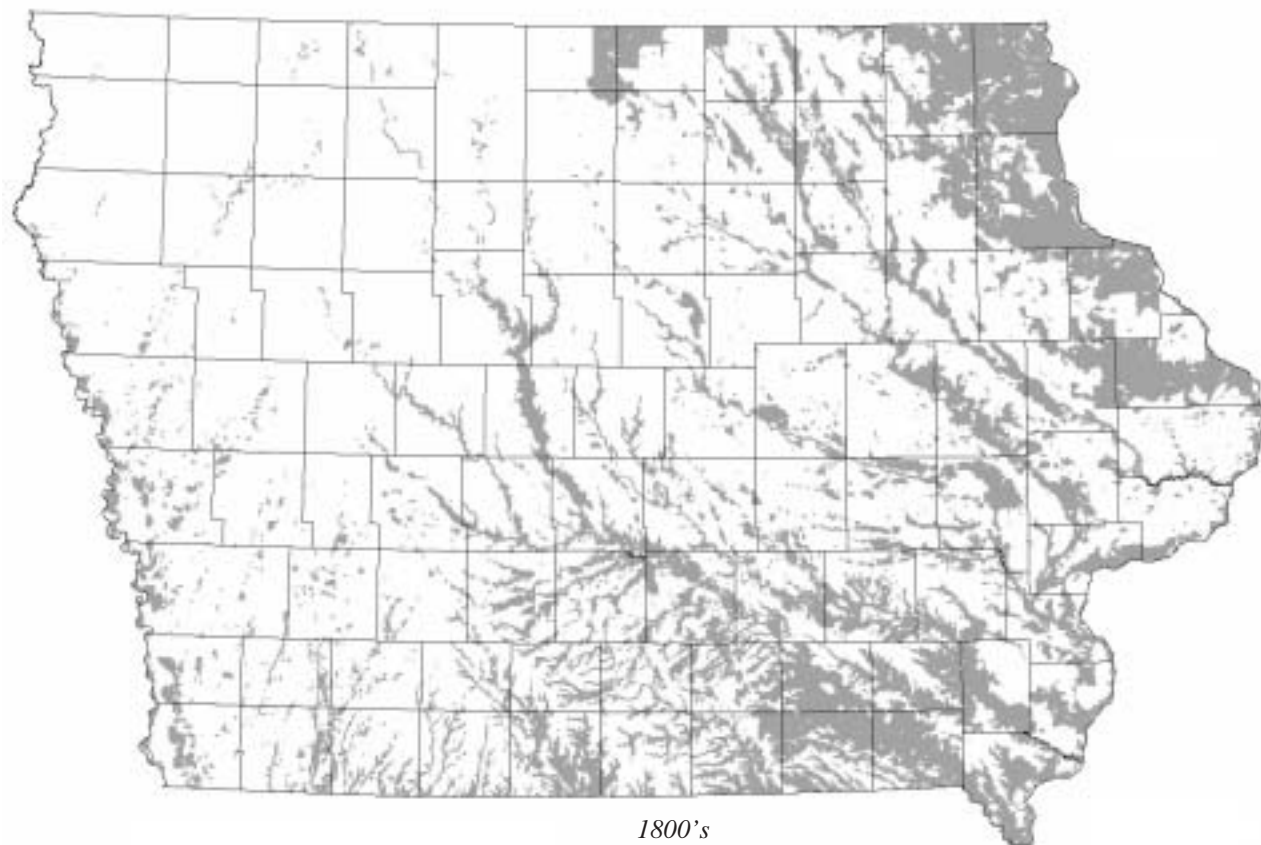
### **History of Iowa's Forest Resource**

Tall grass prairies and forests covered Iowa before settlement. The rich soils and rolling landscape provided raw materials for homes and fertile land for successful agricultural crops. In the mid-1800s, almost one-fifth of the state contained trees (6.7 million acres).

Nearly half the state's forests and 90 percent of prairies were cleared for agricultural by 1900. By 1974, only 1.5 million acres of forest remained as more and more land was cleared to make Midwestern states the "Breadbasket of the World."



## Iowa Forest Cover



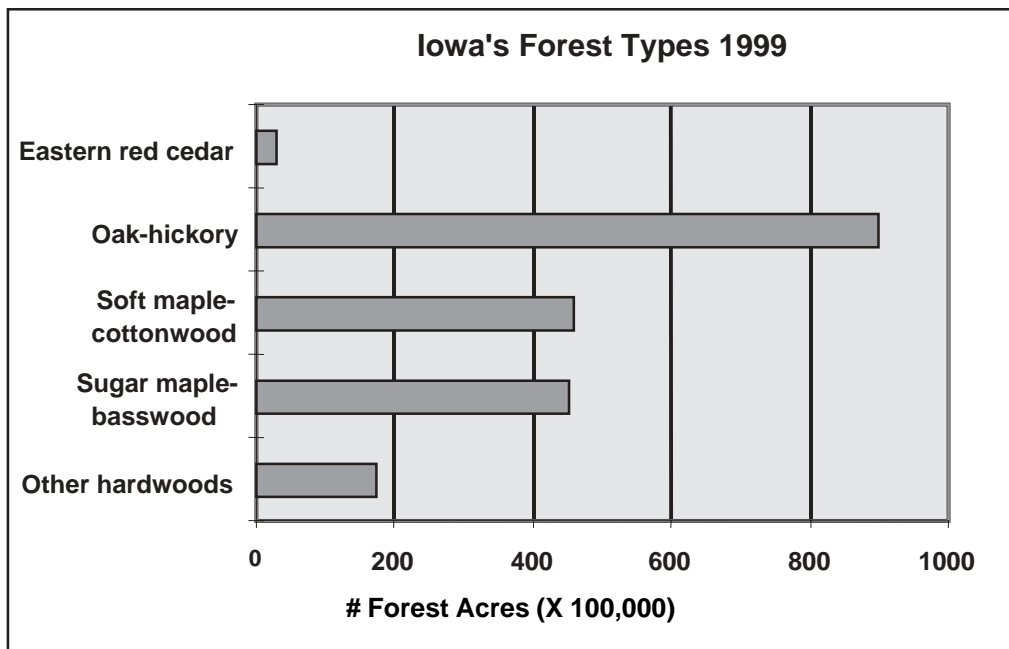


Iowa's forest cover has increased in the past 25 years. Current estimates range from 2.1 to 2.5 million acres. This increase is due in part to reduced livestock grazing and the use of expanded state and federal cost-share reforestation programs by private landowners.

Every county in the state has some forest, but the amount of forest cover varies greatly in different parts of the state. Allamakee County in northeastern Iowa has 32 percent while Grundy and Pocahontas counties in north-central Iowa have less than one percent.

## Iowa's Forest Locations

Iowa's forests are as diverse as the land they cover. From north to south and east to west forests reflect changes in climate, soils, and land use. Hardwood trees dominate, representing more than 95 percent of the total growing stock. Oak and hickory dominate dry upland sites (about half Iowa's forests). Sugar maple and basswood occupy other upland sites. Silver maple, cottonwood, American elm, and green ash dominate bottomland/floodplain forest sites. Balsam fir, white pine, paper birch, and aspen exist in isolated locations in northeastern Iowa, remnants from a time when Iowa's forests were more like the forests common to the Great Lake states to the north.



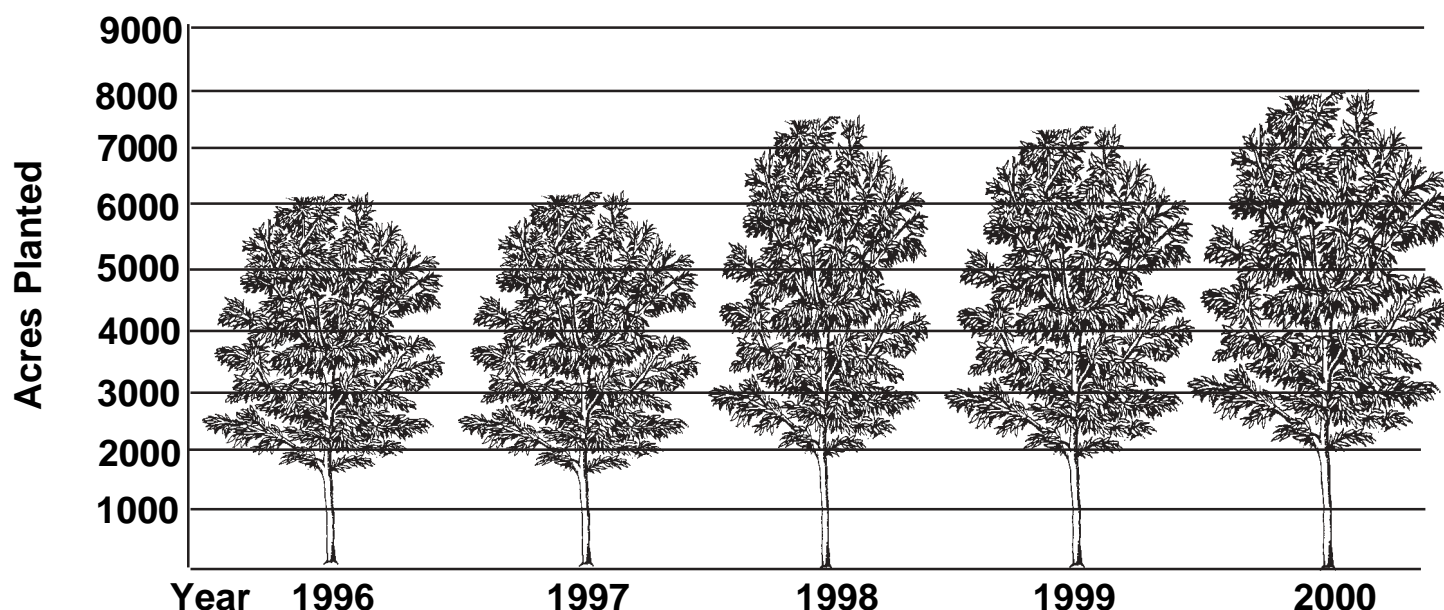
## Unique Iowa Forests

White Pine Hollow in Dubuque County and Bluffton Fir Stand in Winneshiek County are areas of cool **microclimates** (unique environmental conditions in a restricted area). North facing cliffs and cool air currents from underground caves make these areas more like the north woods of Canada than Iowa. White Pine Hollow contains very old white pine trees, Canadian yew, trilliums, and yellow lady's slipper. The Bluffton Fir Stand is the largest known remnant of balsam fir in the state, reminiscent of some interglacial period.

Pecan Grove in Muscatine County is one of the largest, most northern populations of pecan trees. This tree is common further south, but rare in Iowa.

## Future Iowa Forests

Iowa's forests play a vital role in the balance of the state's native ecosystems and wildlife habitats. Through renewed conservation and education efforts Iowa's forests are rebounding slowly. We now have 2.1 million acres! The State Forest Nursery in Ames produces about three to five million plants each year. Volunteers plant hundreds of thousands trees in our communities annually. The future of Iowa's forests is up to us.



Currently, Iowa's forests face several threats: urbanization, invasion of non-native plant species, and non-sustainable timber harvest.

### **Urbanization**

Small wooded areas previously managed by farmers are being cleared for development. Urban expansion in Iowa is increasing, especially around metro areas. Risks (associated with private land development) to commercial or non-traditional forest uses include loss of plant and wildlife habitat, unbalanced ecosystems, loss of scenic and aesthetic values, and pollution of lakes, rivers, and wetlands.

Fragmentation and urbanization threaten Iowa's forests. Connecting and conserving remaining small parcels of forest with other parcels, or with larger, state-owned forests, will extend habitat potential. Iowa Department of Natural Resources (IDNR) district foresters work with private forest landowners (control 92% of Iowa's forests) to help make forest ownership and proper management economical and feasible. The future of Iowa's biological diversity, aesthetics, water and air quality, and forest product industry lies in cooperation to minimize future fragmentation and improve management of private forests.

### ***Non-native invasive plant species***

Pioneers and settlers to Iowa introduced many plant species to our native ecosystems. Most agricultural crops are not native to Iowa. These plants, as well as many ornamentals are, for the most part, non-threatening to native plants.

However, some exotic plants are considered "biological pollution." Many have no natural controls (diseases or predators) in their new environment. They can overwhelm native vegetation, resulting in reduced productivity and biodiversity in forests they occupy. These harmful invaders include multiflora rose, Japanese honeysuckle, buckthorn, and garlic mustard.

### ***Non-sustainable timber harvest***

About 200,000 acres (8 percent) of Iowa forests are owned publicly. State and local governments maintain state forests, state and county parks, forest reserves, and wildlife areas. The federal government maintains some forests for floodplain protection.

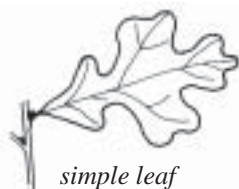
Trends in forest ownership demographics could impact Iowa's future forests. Farmers traditionally have owned Iowa's forests since settlement. Although they still own over half the forests, they are aging and decreasing in number. Over two-thirds of Iowa's forests are owned by individuals over 55, and over 20 percent by landowners over age 75. This could mean that one in five Iowa forest properties changes ownership in the next 10 years.

One of the greatest risks to forests is the inappropriate logging of timber. Logging by selecting only the biggest trees and leaving the small ones to grow often results in removal of only the best trees (high grading or diameter limit cutting). "Taking the best and leaving the worst" reduces the quality of the seed source and gene pool. Compared to other states, Iowa's "saw timber" is in the two poorest grades of saw logs because of these short term logging methods.

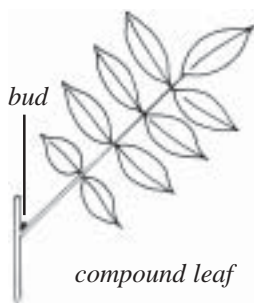
On average, less than half of the annual growth in Iowa's forests is removed each year. This means that Iowa's forests are understocked and could actually produce more wood if they were managed under a sustained forestry effort.

**More than 55,000 individuals own the remaining 92% of Iowa forests**  
~50% live on their forest land  
30% live within 5 miles of their forests  
24% are "absentee" forest owners  
30% have owned their land 20+ years  
24% have owned their land < 5 years

## Tree Identification



*simple leaf*



*compound leaf*



*opposite*



*alternate*



*needle-like leaves*



*scale-like leaves*

It is helpful to be able to identify tree species to understand more about forests. There are two basic types of trees found in Iowa: coniferous and deciduous.

**Conifers** have needle-like leaves that stay on the tree for more than one year. It is better to call these trees “conifers,” rather than “evergreens,” since trees that belong to this class bear cones, but can be deciduous (e.g., larch, bald cypress). Conifers have needle-like leaves coated with a waxy covering that slows **transpiration** (process by which water evaporates from plants). Conifers also produce a cone structure that holds the seeds. Seeds do not have a **seed coat** (protective covering around a seed), so conifers are in the **gymnosperm** (naked seed) order of plants.

**Deciduous** trees have broad leaves they shed each fall and grow new in the spring. Deciduous leaves lack the water saving **adaptations** (attribute of a plant or animal that improves its survival under certain environmental conditions) of conifers and would dry out over the winter. These trees have a different strategy for coping with winter climates; they go dormant. They have protective seed coats on their seeds, which are sometimes very elaborate. This characteristic places them in the **angiosperm** order of plants.

There are many different ways to identify trees. One approach is to compare a leaf or fruit of the tree in question with drawings or photographs in a book, which is fine for common trees, especially during the growing season. Another is to use a tree key. Keys often appear difficult, but really are easy to use if followed carefully. See the simple Iowa tree key and guide included in the appendices and the “Name That Tree” activity for more details on tree identification.

In general, seven clues can be used to successfully identify trees: leaves, bark, fruit, flowers, twigs, overall tree shape, and tree location.

### Leaves

Leaves are the most common clue used for tree identification. Conifers have needle-like or scale-like leaves. Leaves of deciduous trees are either **simple** (one section per leaf) or **compound** (each leaf is made up of more than one section or leaflet). Sometimes it is difficult to tell where the leaf attaches to the branch; the best way to check is to look for a bud. A bud appears on the tree branch just above the **petiole** (leaf stem). If there isn’t a bud at the base of a leaf, it is probably part of a compound leaf. Leaves can be arranged **opposite** or **alternate** one another on a branch. Leaf shapes vary from deep lobed oak leaves to oval shaped elm leaves. Fall color can be a great clue, since certain tree species have unique fall colors. Extra care may be necessary to identify individual species within a family (group of similar species). You may need to compare **leaf margins** (edges) and surfaces.



## Bark

Bark is the most common way foresters identify trees, since it changes little as the tree matures and leaves and twigs may not be accessible on tall trees. The bark of most Iowa trees can be described as smooth, scaly, platy, warty, furrowed, or shaggy. Bark color may also be an identifying characteristic (e.g., birches have white bark).

## Fruit

Looking at the fruit, or seed-bearing structure, is also an easy way to identify trees. Fruits can be described as dry fruits (e.g., nuts, seedpods) or fleshy fruits (e.g., apples, berries).

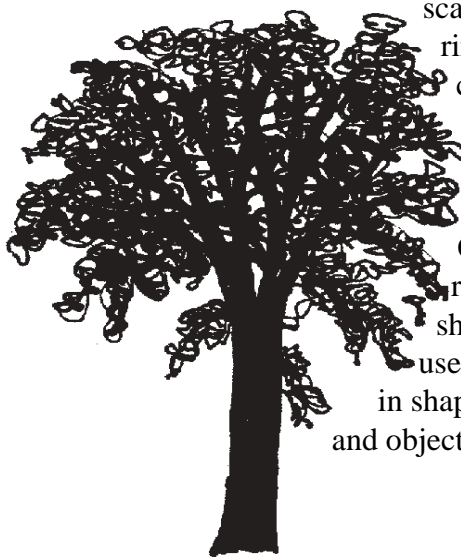
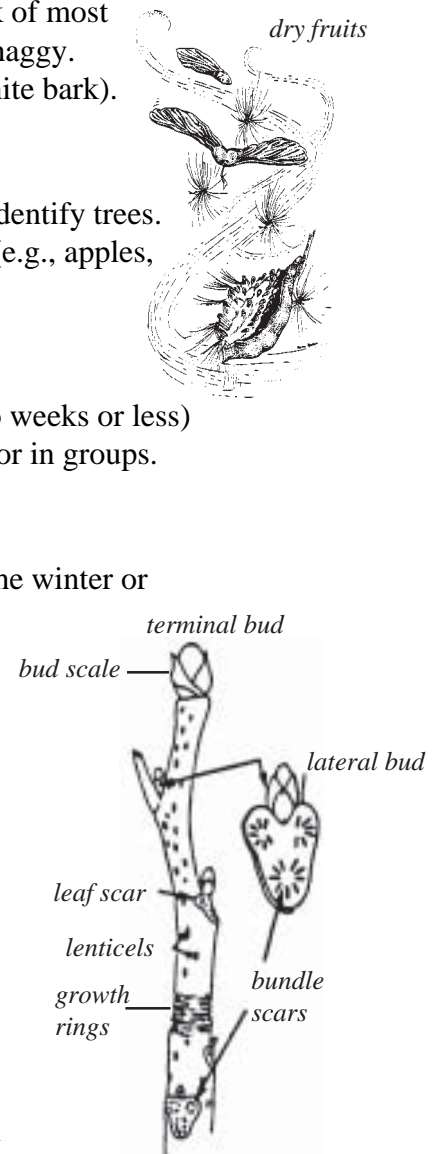
## Flowers

Trees in flower are a sign of spring. Flowers are short-lived clues (two weeks or less) for identification. Note flower shape, color, and whether they grow alone or in groups.

## Twigs

Twigs and buds often are the only way to identify many trees during the winter or dormant period. You must be familiar with some terms to use twigs to identify trees. The **terminal bud** is at the very end of the twig, capping off the growth of that twig for the year. **Lateral buds** are found along the sides of the twig and hold new leaves, flowers, or both for next year. Buds are protected by **scales**. Just below a lateral bud is the spot where last year's leaf fell off, the **leaf scar**. There are tiny dots in each leaf scar called **bundle scars**. These mark where transport tubes carried food and water between the leaf and the twig.

Arrangement of the bundle scars can be distinctive for certain species. The arrangement of the leaf scars on the twig is the same as the leaf arrangement—**alternate** or **opposite**. Small raised dots on the bark of the twig, **lenticels**, are where air exchange takes place for the growing tree. A few inches down from the terminal bud are several lines or dark rings circling the twig. These **growth rings** mark where last year's terminal bud scales fell off. The distance from these growth rings to the present terminal bud is a year's growth. Thorns can also be a big clue.



## Shape

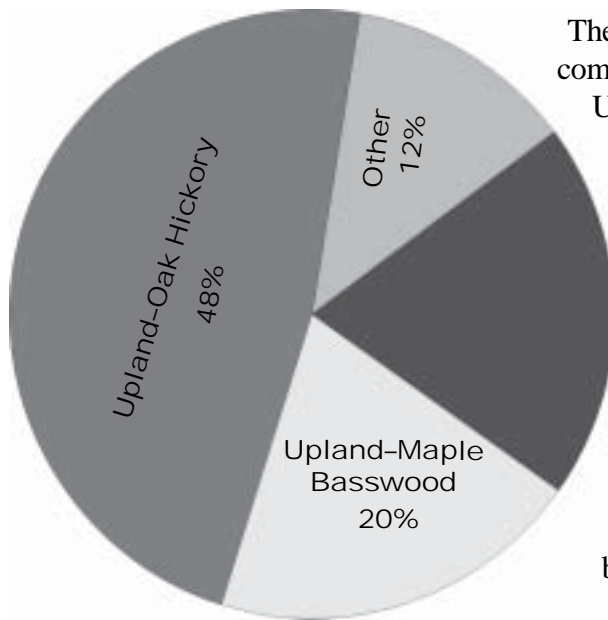
Overall tree shapes or silhouettes are distinctive. Common Iowa tree shapes include: columnar (poplars), round (white oak), pyramidal (spruce), oval (ash), vase-shaped (elms), or weeping (willow). It is usually a good idea to use this clue in combination with others because trees may grow in shapes different from the norm due to crowding from other trees and objects, shading, injuries, etc.

## Tree Location

As you walk through any forest or examine trees along our community streets it becomes apparent that certain trees grow in certain areas (wet, dry, sunny, shady, etc.). Each tree species requires unique conditions to grow—temperature ranges (cold hardiness), soil type(s), moisture, and sunlight. The amount of sun or shade a growing site receives, its soil type and drainage characteristics, and how moist it is are clues to tree identification. For example, cottonwoods grow where the water table is close to the surface while red oaks do best on well-drained soils.

## Iowa's Forests Types

### Upland Forest



*percent of Iowa forest types*

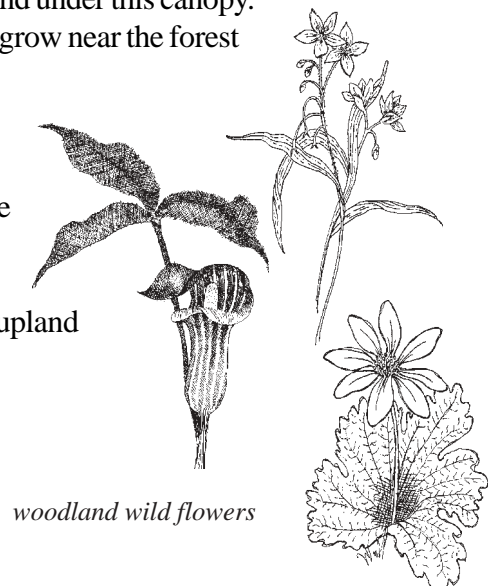
The most common forest type in Iowa is the **upland forest**, composed of oak, hickory, and many other deciduous trees.

Upland forests are located on ridge tops and other areas above the reach of floodwaters. Many upland forests exist in Iowa, since they grow on steep slopes that are unsuitable for agricultural row crops. Several species of oaks can be found in upland forests. White oak and bur oak are found on drier sites, with red oaks mixing in as soil moisture increases down the slope of a ridge.

Shagbark and bittersweet are the most common hickory species. Shagbark hickory is identified by distinctive bark that appears to be peeling off the tree in thick, ragged strips. Bittersweet hickories have smooth bark and, of course, a very bitter tasting nut.

Black walnut, white ash, sugar maple, and basswood can form an upland forest in more moist locations. These trees form a dense canopy, limiting light to the forest floor. Ironwood is one **shade tolerant** (able to grow under low light conditions) tree species found under this canopy. Thickets of plum, chokecherry, sumac, and serviceberry grow near the forest edge where there is more light.

Colorful displays of wildflowers can be found in upland forests before leaf-out. Most woodland wildflowers bloom in early spring to take advantage of the sunlight reaching the forest floor. Bloodroot, Dutchman's breeches, jack-in-the-pulpit, columbine, and showy orchids are just a few of the wildflowers found in Iowa's upland forests.



*woodland wild flowers*

## ***Floodplain Forest***

**Floodplain** or **bottomland forests** are located along major rivers and streams. The area adjacent to a stream is called a **riparian** area. Tree species living in these areas usually have root systems that can withstand being underwater and receiving no oxygen periodically. Floodplain forests often exist in Iowa because they are too wet to farm.

Floodplain forest trees include silver maple, green ash, and hackberry, with cottonwoods, willows, and boxelders growing closest to the water. Most of these grow faster than upland forest trees. **Alluvial soils** (develop when sediments settle out of the water that carried them) on a floodplain are less stable than upland soils, so a fast growing tree has a better chance of gaining a foothold. Nettles, wild grape, Virginia creeper, and poison ivy commonly are found under the trees in a floodplain forest.

## ***Oak Savanna***

The rarest type of naturally occurring forest in Iowa probably is the oak savanna. A savanna forms in the midst of prairie and has an open park-like appearance. The trees are large, wide branching, widely spaced bur or white oaks. The shrub layer is absent and prairie plants cover the ground under the trees.

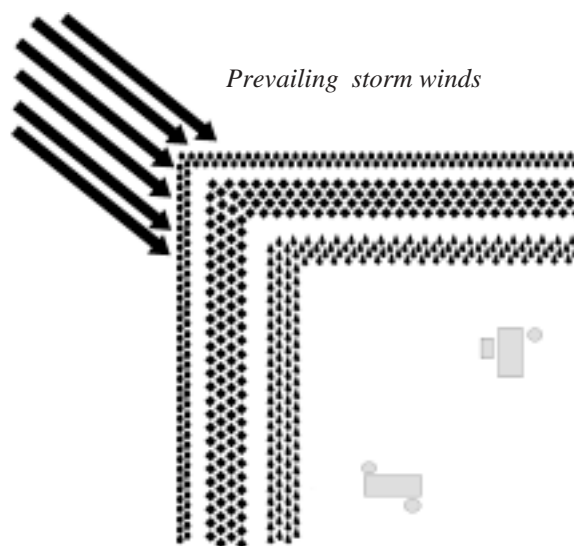
A savanna develops when a prairie is protected from fire long enough for the oak trees to grow large enough to tolerate a burn. Oak trees, especially bur oaks, have very thick cork-like bark that “fireproofs” the tree. Fire is an important element in maintaining a savanna; preventing shrubs and smaller trees from growing and keeping prairie plants healthy.

When the prairie was turned into crop fields, the fires that swept the plains stopped. Many savannas probably were converted to other land uses or, without the periodic fires that maintained them, grew up into other forest types.

## ***Windbreaks***

**Windbreaks** are multiple rows of trees and shrubs usually placed on the north and west sides of buildings. The main ingredients are rows of conifer trees to block the wind. Large and small deciduous trees are included to direct wind flow. Rows of shrubs catch snow and can provide food for wildlife.

Windbreaks can reduce home heating bills, reduce stress on livestock, protect crops and soil, provide fuel wood, produce fruits and nuts, provide wildlife habitat, and enhance property values.



## **Urban Forest**

Iowa's **urban forests** are comprised of trees that grow along streets, in city parks, and in suburban neighborhoods. Iowa's 950 communities average 30 percent tree cover—approximately 44,000 acres. Until the late 1960s, the most common tree in Iowa communities was the American elm. Dutch elm disease eliminated hundreds of thousands of American elms around the state. Today, an average urban forest in Iowa has 30-45 species of trees, but the most common are green ash, silver maple, sugar maple, and Norway maple.

Trees reduce pollution and cool the city. They reduce runoff and hold soil in place. This helps protect nearby streams from sediments and chemicals that could be carried in runoff water. Trees also provide habitat for urban wildlife.

Trees in urban and community settings increase individual property values by five to 15 percent. Many communities utilize urban reforestation programs to attract and retain businesses as well as citizens. For example, in Des Moines, the city government requires new business developers to replant newly developed land with large, landscape-sized trees and protect existing trees on the property where possible. However, urban expansion and natural tree aging, coupled with tight local government budgets, has limited tree maintenance and replacement.

## **Plantations**

A **plantation** is an area planted to trees specifically for future harvest. Tree plantations, while not as diverse as a naturally occurring forest, provide valuable cover for many wildlife species. Approximately 7,200 acres are planted to woody plantations in Iowa each year.

One difference between trees and other types of crops is the time between planting and a cash return. In the case of hardwood plantations, (e.g., black walnut) the planter's children more than likely will harvest the crop. Energy plantations are made up of fast growing trees planted for harvest as fuel wood.

Christmas tree farms are probably the most familiar type of plantation. They are quite labor intensive; the trees require pruning and shaping and protection from insects, disease, and herbivores. A Christmas tree crop is harvestable within about seven years of planting. There are over 300 active Christmas tree growers with approximately 2,500 acres of trees in Iowa. Over 50,000 Iowa Christmas trees are harvested each year. Two trees are planted for each one harvested.





## Other Materials

- 20 Common Trees of Iowa. 1997. (available from: IDNR Forest Bureau, [www.iowadnr.com/forestry/index.html](http://www.iowadnr.com/forestry/index.html), 515/281-5441)
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- Trees for Kids. 1993. Des Moines: Iowa Department of Natural Resources.
- Zim, H.S. and A.C. Martin. 1956. A Golden Guide to Trees. New York: Golden Press.
- [ortho.gis.iastate.edu/](http://ortho.gis.iastate.edu/) (Iowa Geographic Image Map Server—access to digital aerial photos, relief maps, topographic maps, and land cover maps from satellite imagery)
- [plants.usda.gov](http://plants.usda.gov) (Natural Resources Conservation Service) (fact sheets, photos, endangered/threatened and invasive/introduced plants descriptions)
- [www.extension.iastate.edu/pages/tree](http://www.extension.iastate.edu/pages/tree) (Identification of Common Trees of Iowa—An Interactive Key)
- [www.forestryimages.org](http://www.forestryimages.org) (over 600 images of hardwood and conifer trees)

## PLT Activities (grade level)

<i>A Look at Lifestyles (5-8)</i>	<i>Life on the Edge (4-8)</i>
<i>Adopt a Tree (3-8)</i>	Looking At Leaves (K-4)
Closer You Look, The (PreK-6)	<i>Name That Tree (2-8)</i>
<i>Environmental Exchange Box (K-8)</i>	<i>Nothing Succeeds Like Succession (3-6)</i>
<i>Field, Forest, and Stream (4-8)</i>	People of the Forest (5-8)
Get in Touch With Trees (PreK-6)	Soil Stories (5-8)
Habitat Pen Pals (3-6)	Watch on Wetlands (7-8)
<i>How Big is Your Tree? (3-8)</i>	

\* *Supplemental information provided for italicized activities.*

